

# Grade 10 Science Karnataka 2024

Maximum Score : 80

## Part - A (Physics)

### I. Multiple choice questions

$3 \times 1 = 3$

Q1. SI unit of electric charge is

- (A) coulomb
- (B) ampere
- (C) joule
- (D) volt

**Solution:**

Correct answer: (A)

The SI unit of electric charge is the coulomb (C). One coulomb is the amount of charge transported by a current of one ampere in one second.

Q2. In Fleming's left-hand rule the middle finger represents the direction of:

- (A) magnetic field
- (B) current
- (C) movement of conductor
- (D) induced current

**Solution:**

Correct answer: (B)

In Fleming's Left-Hand Rule, the middle finger represents the direction of current, the index finger indicates the magnetic field, and the thumb shows the motion of the conductor.

Q3. Type of the mirror used in vehicles as rear view mirror is

- (A) plane mirror
- (B) concave mirror
- (C) convex mirror
- (D) planoconcave mirror

**Solution:**

Correct answer: (C)

A convex mirror is used in vehicles as a rear-view mirror because it provides a wider field of view and always forms an erect and diminished image, helping drivers see more area behind them.

**II. Answer the following questions:**

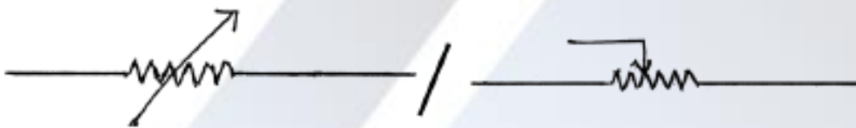
**2 × 1 = 2**

**Q4.** Write the symbols of the following components used in an electric circuit.

- i) A rheostat
- ii) A wire joint.

**Solution:**

i)



ii)



**Q5.** What is spectrum of white light?

**Solution:**

The spectrum of white light is the band of seven colors (Violet, Indigo, Blue, Green, Yellow, Orange, and Red) obtained when white light passes through a prism.

**III. Answer the following questions:**

**3 × 2 = 6**

**Q6.** Give reason:

- a) The tungsten is used in filaments of electric lamps.
- b) In domestic circuits the electric devices are not connected in series.

**Solution:**

a) Tungsten has a very high melting point and resistivity, so it does not melt easily at high temperatures. Since electric lamps glow at very high temperatures, tungsten is mainly used as the heating element in bulbs.

b) Different electrical components require different amounts of current to function properly. In a series circuit, if one component fails, the entire circuit is broken, and no device works. Hence, a series arrangement is not used in domestic wiring.

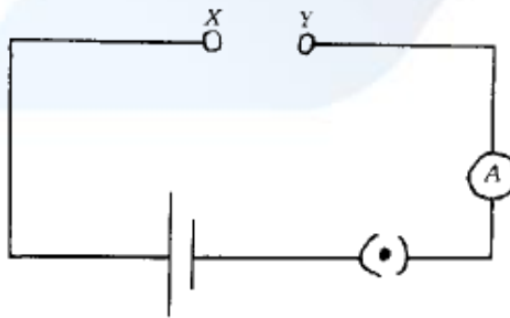
**OR**

Placing a 'fuse' in electric circuits is essential. Why ? Explain.

**Solution:**

A fuse is a safety device that protects electric circuits and appliances by stopping excessive current flow. It consists of a wire made from a metal or alloy with a suitable melting point, placed in series with the device. If the current exceeds the limit, the fuse wire heats up, melts, and breaks the circuit, preventing damage.

**Q7.** Observe the electric circuit:



When a wire of resistance ' $R$ '  $\Omega$  is connected between 'X' and 'Y', then the ammeter reading is 3A. If ' $R$ '  $\Omega$  resistance is replaced by ' $2R$ '  $\Omega$  in the same circuit, what would be the reading in ammeter? Give scientific reason for your answer.

**Solution:**

When a wire of resistance ' $R$ '  $\Omega$  is connected between points 'X' and 'Y', the ammeter reading is 3A.

Using Ohm's law,

$$V = IR$$

$$V = (3A) \times R$$

$$V = 3R$$

Now, if the resistance is changed to ' $2R$ '  $\Omega$ ,

$$V = 3R \text{ (since the voltage remains the same)}$$

Using Ohm's law again,

$$V = I \times R$$

$$I = V / R$$

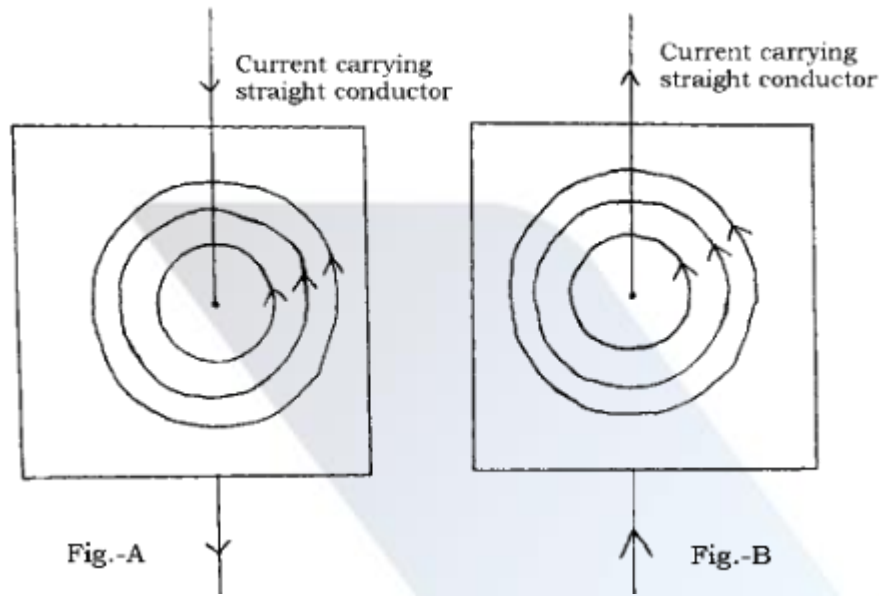
$$I = 3R / 2R$$

$$I = 1.5A$$

So, the ammeter reading will be 1.5A.

Reason: When the resistance is doubled, the current is halved.

**Q8.** Observe the given figures and answer the questions that follow:



- Which of the above figures shows the correct direction of magnetic field?
- Name and state the rule that helped to choose the correct figure.

**Solution:**

- Figure (b) shows the correct direction of the magnetic field.
- The right-hand thumb rule helps determine the correct direction.

When holding a current-carrying straight conductor in your right hand, position the thumb to show the direction of the current. The fingers wrapping around the conductor will then indicate the direction of the magnetic field lines.

**IV. Answer the following questions:**

**3 × 2 = 6**

- Q9.** A concave lens has focal length of 30 cm . At what distance should the object from the lens be placed so that it forms an image at 20 cm from the lens ?

**Solution:**

Given:

Focal length ( $f$ ) = -30 cm (since it's a concave lens)

Image distance ( $v$ ) = -20 cm (since the image is virtual and on the same side as the object)

Using the lens formula:

$$1/f = 1/v - 1/u$$

Substituting the given values:

$$1/(-30) = 1/(-20) - 1/u$$

Solving for u:

$$1/u = 1/(-20) - 1/(-30)$$

$$1/u = (-3 + 2) / 60$$

$$1/u = -1/60$$

Therefore,

$$u = -60 \text{ cm}$$

Thus, the object should be placed 60 cm in front of the concave lens.

**OR**

- a) Find the focal length of a convex mirror whose radius of curvature is 6 cm .
- b) Find the power of convex lens of focal length 0.2 m.

**Solution:**

a) Focal length of a convex mirror:

Given:

Radius of curvature (R) = +6 cm (for convex mirror)

Using the formula for focal length:

$$f = R/2$$

$$f = 6/2 = 3 \text{ cm}$$

Thus, the focal length of the convex mirror is 3 cm.

b) Power of a convex lens:

Given:

Focal length (f) = 0.2 m

Using the formula for power:

$$P = 1/f \text{ (in meters)}$$

$$P = 1/0.2$$

$$P = +5 \text{ D}$$

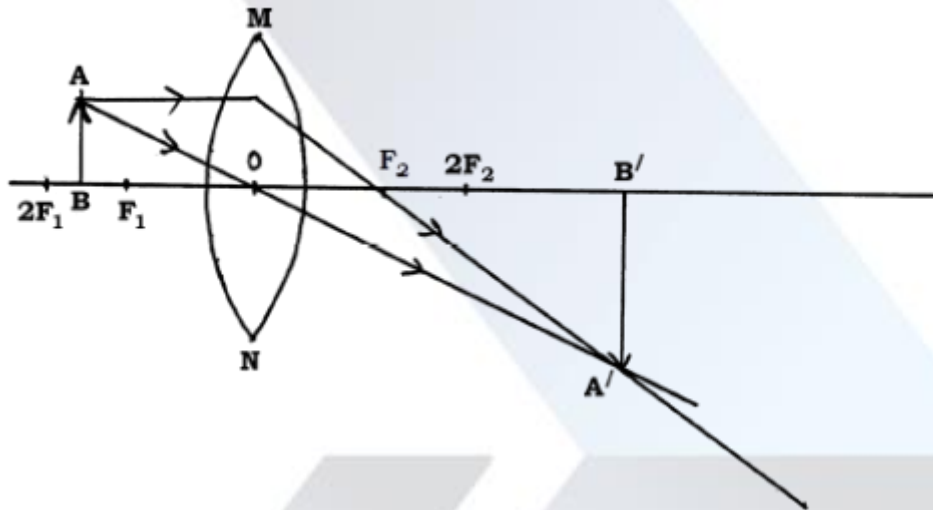
Thus, the power of the convex lens is +5 D.

**Q10.** Draw the ray diagram for the image formation in a convex lens when the object is placed between  $2F_1$  and  $F_1$ .

Mention the position and nature of the image formed.

[ $F_1$  : Principal focus of the lens]

**Solution:**



The nature of image is — Real and inverted —

Position of image is — Beyond  $2F_2$

**Q11.** What are the characteristics of a good source of energy?

Write any two uses of solar cells.

**Solution:**

**Characteristics of a good source of energy:**

- A good source of energy should:
- Provide a large amount of work per unit of volume or mass.
- Be easily accessible.
- Be easy to store and transport.
- Be economical.

**Uses of solar cells:**

- Solar cells are used in artificial satellites and space probes.
- They are used in traffic signals, calculators, toys, streetlights, vehicles, and watches.

**OR**

What are the advantages and disadvantages of nuclear energy?

**Solution:**

**Advantages of nuclear energy:**

- Nuclear energy releases a tremendous amount of energy.
- It is used in the generation of electrical energy.
- It has applications in the manufacturing of nuclear weapons.

**Disadvantages of nuclear energy:**

- Improper storage and disposal of nuclear waste can lead to environmental contamination.
- There is a risk of accidental leakage of radiation.
- The installation of nuclear power plants is costly.

**V. Answer the following questions:**

**2 × 4 = 8**

**Q12.** Explain Faraday's experiment related to the electromagnetic induction.

**Solution:**

Faraday made a significant discovery on how a moving magnet can generate electric current. The experiment can be explained as follows:

1. Take a coil of wire with many turns.
2. Connect the ends of the coil to a galvanometer.
3. Use a strong bar magnet and move its north pole towards one end of the coil.
4. This causes a momentary deflection in the galvanometer needle, indicating a current is produced in the coil. Once the magnet stops moving, the deflection goes back to zero.



5. If the north pole is moved away from the coil, the galvanometer needle deflects in the opposite direction, indicating the current is now flowing in the opposite direction.
6. If the north pole remains stationary near the coil and the coil is moved towards it, the galvanometer needle deflects to the right. Similarly, when the coil is moved away, the needle deflects to the left.
7. If the coil is stationary with respect to the magnet, the deflection of the galvanometer drops to zero.

The experiment clearly shows that the motion of the magnet relative to the coil produces an induced potential difference, which sets up an induced electric current in the circuit.

- Q13.** a) How does the eye accommodate to see far and near objects?  
 b) Why do stars twinkle? Explain.

**Solution:**

- a) The eye lens is made of a fibrous, jelly-like material, and its curvature can be altered by the ciliary muscles.
  - When the ciliary muscles relax, the lens becomes thinner, increasing its focal length, which helps in seeing distant objects clearly.
  - When looking at objects closer to the eye, the ciliary muscles contract, making the lens thicker, which decreases its focal length and allows for clear vision of nearby objects.
- b) Stars twinkle due to atmospheric refraction of light.
  - As starlight enters the Earth's atmosphere, it undergoes continuous refraction due to the changing refractive index of the atmosphere.
  - The atmosphere bends the starlight towards the normal, causing the apparent position of the star to shift slightly. This position is not fixed and keeps changing.
  - Since stars are very far away, they appear as point-sized sources of light. The slight variation in the path of the rays causes the apparent

position of the star to fluctuate, which results in the star's brightness changing, creating the twinkling effect.

## Part - B (Chemistry)

### VI. Multiple choice questions:

$3 \times 1 = 3$

**Q14.** In the electrolysis of water the gases that are released at cathode and anode and their ratio respectively are,

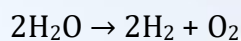
- (A) Hydrogen : Oxygen ; 1:2
- (B) Oxygen : Hydrogen ; 2:1
- (C) Hydrogen : Oxygen : 2:1
- (D) Oxygen : Hydrogen ; 1:2

**Solution:**

Correct answer: (C)

During the electrolysis of water, water ( $\text{H}_2\text{O}$ ) splits into hydrogen ( $\text{H}_2$ ) and oxygen ( $\text{O}_2$ ) gases.

- At the cathode (-ve electrode), hydrogen gas ( $\text{H}_2$ ) is released.
- At the anode (+ve electrode), oxygen gas ( $\text{O}_2$ ) is released.
- The ratio of hydrogen to oxygen is 2:1, as per the balanced chemical equation:



**Q15.** The compound used to remove the permanent hardness of water is

- (A) sodium carbonate
- (B) sodium hydroxide
- (C) sodium hydrogen carbonate
- (D) sodium chloride

**Correct answer: (A)**

**Solution:**

Correct answer: (A)

Sodium carbonate ( $\text{Na}_2\text{CO}_3$ ), or washing soda, removes permanent hardness of water by reacting with calcium ( $\text{Ca}^{2+}$ ) and magnesium ( $\text{Mg}^{2+}$ ) ions to form insoluble precipitates. This process softens the water by eliminating hardness-causing salts.

**Q16.** A limitation of Mendeleev's classification of elements among the following is

- (A) keeping two elements in the same slot
- (B) this classification is only applied up to calcium
- (C) this classification worked only for lighter elements
- (D) no fixed position is given to hydrogen in the periodic table.

**Solution:**

Correct answer: (D)

Mendeleev's classification had a major limitation regarding hydrogen, as it showed properties similar to both alkali metals (Group 1) and halogens (Group 17). Due to this dual nature, Mendeleev could not assign hydrogen a fixed position in his periodic table, making it a significant drawback of his classification.

**VII. Answer the following questions**

**3 × 1 = 3**

**Q17.** The molecular formula of the fourth member of a homologous series is  $\text{C}_5\text{H}_{10}$ . Then, determine and write the molecular formulae of first two members of the same series.

**Solution:**

The molecular formula of the fourth member is  $\text{C}_5\text{H}_{10}$ .

By subtracting  $-\text{CH}_2$  for each previous member, the first two members are:

First member:  $\text{C}_2\text{H}_4$

Second member:  $\text{C}_3\text{H}_6$

**Q18.** What are redox reactions?

**Solution:**

Redox reactions are chemical reactions in which there is a transfer of electrons between two substances. One substance gets oxidized (loses electrons), and the other gets reduced (gains electrons).

Oxidation: Loss of electrons.

Reduction: Gain of electrons.

**Q19.** 250 ml of water is taken in each of beaker 'A' and beaker 'B'. About 5 gm of sodium metal is added to the beaker 'A' and about 5 gm of calcium metal is added to beaker 'B'. What are the reasons for the observations that have been noticed here?

**Solution:**

**Beaker A:** When sodium reacts with water, the reaction is highly exothermic and violent. This releases a significant amount of heat, causing the hydrogen gas produced to ignite instantly.

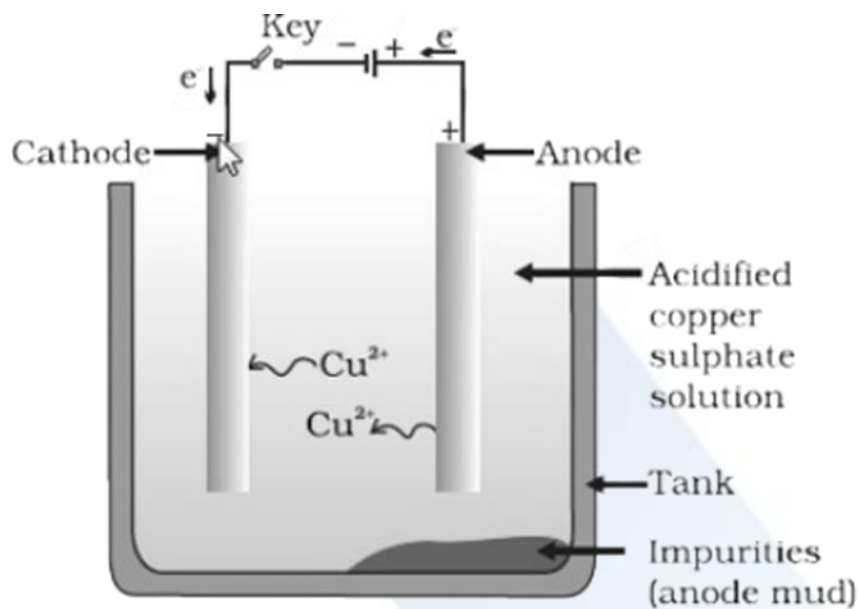
**Beaker B:** The reaction between calcium and water is less violent, and the heat released is not enough to ignite the hydrogen gas, leading to a less dramatic reaction compared to sodium.

**VIII. Answer the following questions:**

**3 × 2 = 6**

**Q20.** Draw the diagram to show the arrangement of the apparatus used in the refining of copper and label 'anode mud'.

**Solution:**



**Q21.** An iron nail is immersed in copper sulphate solution. Then what type of chemical reaction happens here? Write the balanced chemical equation for this reaction.

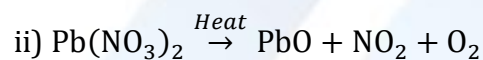
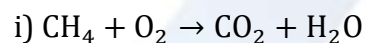
**Solution:**

The reaction when an iron nail is immersed in copper sulfate solution is a displacement reaction where iron displaces copper from copper sulfate solution.

Balanced chemical equation:  $\text{Fe} + \text{CuSO}_4 \rightarrow \text{FeSO}_4 + \text{Cu}$ .

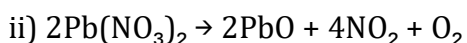
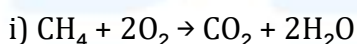
**OR**

Balance the following equations:



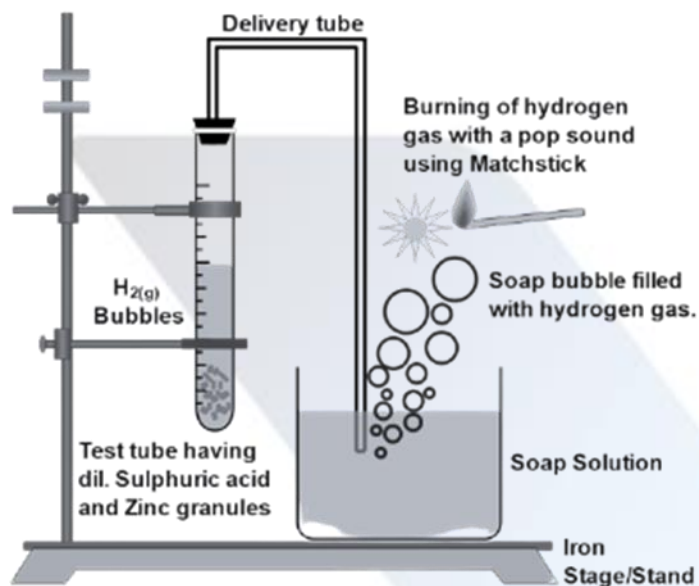
**Solution:**

Balanced chemical equations:



**Q22.** Draw the diagram of the arrangement of apparatus showing the reaction of zinc granules with dilute sulphuric acid and testing of hydrogen gas by burning and label the hydrogen gas bubbles.

**Solution:**



**IX. Answer the following questions:**

**3 × 2 = 6**

**Q23.** What are ionic compounds ? Write any four properties of ionic compounds.

**Solution:**

Ionic compounds are formed by the transfer of electrons from a metal to a non-metal.

**Properties of Ionic Compounds:**

- Physical nature: Solid and hard.
- Melting and boiling points: High.
- Solubility: Soluble in water.
- Conduction of electricity: Conduct electricity in the molten state.

**OR**

What are alloys ? Write any four physical properties of metals.

**Solution:**

Alloys are homogeneous mixtures of two or more metals, or a metal and a non-metal.

**Physical Properties of Metals:**

- Hard
- Lustrous surface
- Ductility
- Malleability
- Good conductors of heat
- Good conductors of electricity
- Sonorous

**Q24.** Solutions 'A', 'B', 'C' and 'D' are having pH values of 2, 6, 8 and 13 respectively.

Then

- which solution has more  $H^+$  and which solution has more  $OH^-$  ions concentration? Why?
- which solutions can be made to react each other to get neutral salts?

**Solution:**

i.) Solution A has more  $H^+$  ions concentration because a lower pH value indicates higher acidity and more hydrogen ions.

Solution D has more  $OH^-$  ions concentration because a higher pH value (above 7) indicates basicity, leading to a higher concentration of hydroxide ions.

ii.) Solutions A and D can react to form neutral salts, as A is acidic and D is basic. Solutions B and C can also react, as both are near neutral but with B being slightly acidic and C slightly basic.

**Q25.** Observe the given part of periodic table and answer the following questions:

Elements	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
Atomic number	3	4	10	11	18

- Which elements have +1 valency?
- Which elements belong to the group of noble gases? Why?
- Mention the place of element 'b' in the modern periodic table.

**Solution:**

- i) Elements 'a' (Lithium, atomic number 3) and 'd' (Sodium, atomic number 11) have +1 valency as both have 1 electron in their outermost shell, which they lose to form a +1 ion.
- ii) Elements 'c' (Neon, atomic number 10) and 'e' (Argon, atomic number 18) belong to the noble gases group. They have a full outer electron shell (octet configuration), making them stable and chemically inert.
- iii) Element 'b' (Beryllium, atomic number 4) is located in Period 2 and Group 2 of the modern periodic table.

**X. Answer the following question:**

**3 × 2 = 6**

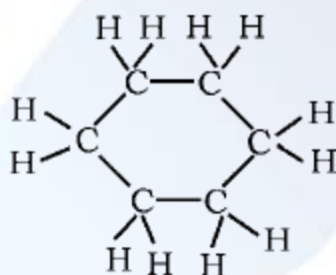
**Q26.** a) Write the structures for the following carbon compounds.

- i) Cyclohexane
- ii) Propanoic acid

b) Write any two differences between saturated and unsaturated carbon compounds.

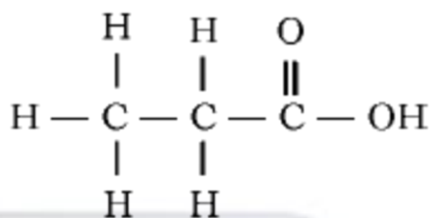
**Solution:**

- a) i) Cyclohexane



- ii) Propanoic acid





b) The difference between saturated and unsaturated carbon compounds are -

Saturated carbon compounds	Unsaturated carbon compounds
<ul style="list-style-type: none"> <li>• Single bond between carbon atoms</li> </ul>	<ul style="list-style-type: none"> <li>• One or more double or triple bond</li> </ul>
<ul style="list-style-type: none"> <li>• Less reactive</li> </ul>	<ul style="list-style-type: none"> <li>• More reactive</li> </ul>
<ul style="list-style-type: none"> <li>• Burn with a clean flame</li> </ul>	<ul style="list-style-type: none"> <li>• Burns with a yellow flame with black smoke</li> </ul>
<ul style="list-style-type: none"> <li>• Undergo substitution and addition reaction</li> </ul>	<ul style="list-style-type: none"> <li>• Undergo addition reaction</li> </ul>

### Part - C (Biology)

#### XI. Multiple choice questions:

2 × 1 = 2

- Q27. The hormone secreted by the pancreas,
- (A) regulates metabolic activities
  - (B) regulates blood sugar level
  - (C) stimulates the growth in the body organs
  - (D) increases breathing rate

#### Solution:

Correct answer: (B)

The pancreas secretes insulin and glucagon, hormones that regulate the blood sugar level in the body. Insulin lowers blood sugar by promoting the uptake of

glucose into cells, while glucagon raises blood sugar by stimulating the liver to release stored glucose.

- Q28.** Suction pressure in plants is required to,
- (A) remove the difference in concentrations of ions between the root and soil
  - (B) transport food in two directions
  - (C) take up the water to the highest parts
  - (D) eliminate excess of water from the leaves

**Solution:**

Correct answer: (C)

Suction pressure in plants is generated mainly during transpiration, which creates a negative pressure in the plant's xylem vessels. This pressure helps in drawing water from the roots through the stem and up to the leaves, especially to the highest parts of the plant.

**XII. Answer the following questions:**

**3 × 1 = 3**

- Q29.** "Reflex arcs are more efficient for quick responses in animals." Justify this statement.

**Solution:**

Reflex arcs allow for immediate responses without involving the brain, making them faster and more efficient. In emergencies, such as withdrawing a hand from a hot object, reflex actions help prevent injury. The pathway involves sensory neurons, the spinal cord, and motor neurons, ensuring a quick, automatic reaction.

- Q30.** Draw the diagram of open stomata and label the guard cells.

**Solution:**

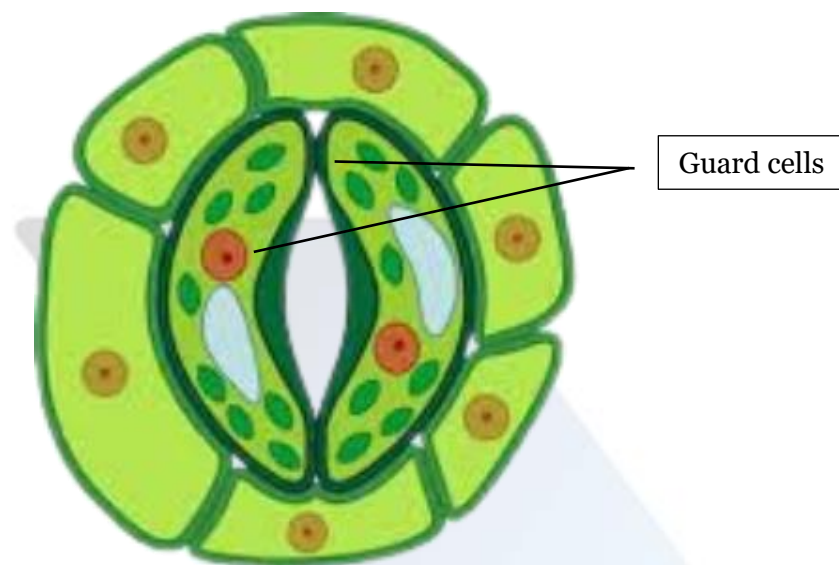


Fig. Open stomata

**Q31.** Is self-pollination possible in flowers having only stamen? Clarify your answer.

**Solution:**

No, self-pollination is not possible in flowers having only stamens, as they lack the carpel (female reproductive part). Self-pollination requires both stamens (male) and carpels (female) in the same flower or plant. Flowers with only stamens are male flowers, which can only participate in cross-pollination.

**XIII. Answer the following questions:**

**2 × 2 = 4**

**Q32.** The body size of a person is changed due to exercises. Is this change can be seen in next generation ? Mention your answer with reason.

**Solution:**

No, changes in body size due to exercise are not inherited because they are acquired traits. Acquired traits result from environmental factors and do not cause genetic changes in DNA. Only genetic traits, such as height and eye color, are passed on to the next generation.

**Q33.** Observe the given food chain and answer the following questions :

Green plants → Deer → Tiger  
 $T_1$                        $T_2$                $T_3$

- i) What is the amount of energy do green plants have if the energy available to the tiger is 700 kJ?
- ii) The organism of which trophic level has the maximum accumulation of harmful chemicals? Why?

**Solution:**

i) According to the 10% energy law, each trophic level receives only 10% of the energy from the previous level.

If the tiger ( $T_3$ ) has 700 kJ, then the deer ( $T_2$ ) had 7000 kJ, and the green plants ( $T_1$ ) had 70,000 kJ.

ii) The top carnivores like tigers accumulate the highest amount of harmful chemicals because these substances increase as they move up the food chain. Toxic chemicals, such as pesticides, do not break down easily and build up in organisms at higher levels.

**XIV. Answer the following questions:**

**3 × 3 = 9**

**Q34.** How are the process of reproduction in hydra and planaria different from each other ?

**Solution:**

*Hydra:*

- Reproduces through budding.
- A bud forms as an outgrowth due to repeated cell division at a specific spot.
- The bud grows and eventually separates to become an independent organism.

*Planaria:*

- Reproduces through regeneration.
- Specialized cells multiply rapidly, producing a large number of new cells.

- These cells undergo changes to form different tissues and develop into a complete organism.
- Each cut piece of planaria can grow into a new individual.

**OR**

How does a fertilized egg in the uterus develop into an embryo ? How does this embryo get nourishment in the mother's womb ? Explain.

**Solution:**

After fertilization, the zygote divides many times to form a ball of cells, which attaches to the uterus. This attached structure develops into an embryo. The embryo receives nourishment through the placenta, a special organ that connects it to the mother's uterus. The placenta provides oxygen, nutrients, and removes waste, helping the embryo grow properly.

**Q35.** Draw the diagram showing the structure of human brain. Label the following parts:

- Cerebrum
- Cerebellum

**Solution:**



Fig. Human brain

**Q36.** Forests are 'biodiversity hot spots'. How? Local people are the stakeholders of forests. Why? Explain.

**Solution:**

Forests are called 'biodiversity hotspots' because they are home to a wide variety of life forms, including bacteria, fungi, ferns, flowering plants, insects, birds, reptiles, and many others.

Local people rely on forests for firewood, timber, thatch, and bamboo to build huts and make baskets. They also need wood for making agricultural, fishing, and hunting tools, as well as for collecting fruits, nuts, medicines, and fodder for cattle.

**XV. Answer the following questions:**

**1 × 4 = 4**

**Q37.** a) What is speciation? List the factors responsible for the speciation.

b) What are fossils? Mention the ways of dating fossils.

**Solution:**

a) Speciation is the process by which new and distinct species arise from a common ancestor.

**Factors responsible for speciation:**

- Gene flow/genetic drift
- Natural selection
- Geographical separation
- Change in the number of chromosomes
- Change in DNA

b) Fossils are the preserved remains or traces of ancient organisms.

**Ways of dating fossils:**

- **Relative method:** Dating fossils by comparing their position in rock layers.
- **Carbon dating:** Detecting the ratios of different isotopes of the same element in the fossil material.

**OR**

a) According to Mendel what are dominant traits and recessive traits?

b) What is dihybrid cross ? What is the ratio of plant types obtained in the F<sub>2</sub> generation of Mendel's dihybrid experiment?

**Solution:**

a) **Dominant traits:** The traits that are expressed in the progeny when one copy of the gene is present.

**Recessive traits:** The traits that are not expressed in the presence of a dominant allele, showing up only when both alleles are recessive.

b) **Dihybrid cross:** A genetic cross between two individuals that differ in two traits, where each parent is heterozygous for both traits.

Ratio in the F<sub>2</sub> generation: 9 : 3 : 3 : 1

**XVI. Answer the following questions:**

**1 × 4 = 4**

**Q38.** a) How does glucose convert into energy molecule during aerobic respiration ?

What is the role of alveoli in the process of respiration?

b) What are the different excretory strategies found in plants?

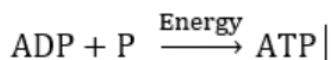
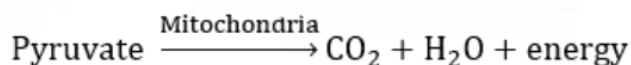
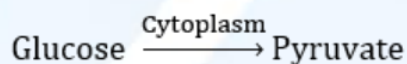
**Solution:**

a) In the cytoplasm, glucose breaks down into pyruvate.

In the mitochondria, the pyruvate is further broken down into carbon dioxide and water.

The energy released during respiration is used to synthesize ATP molecules.

Equation:



**Role of alveoli in respiration:**

The walls of alveoli contain a network of blood vessels, providing a surface for the exchange of gases (oxygen and carbon dioxide) between the air and blood.

**b) Excretory strategies in plants:**

- Plants get rid of excess water through transpiration.
- Many plant waste products are stored in cellular vacuoles.
- Some waste products are stored in leaves that eventually fall off.
- Waste products may be stored as resins and gums in old xylem.
- Plants use tissues consisting of dead cells for excretion and may shed parts like leaves.
- Plants also excrete waste substances into the soil surrounding them.